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The Mineral Industry of Sweden

UNITED STATES DEPARTMENT OF THE INTERIOR

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UNITED STATES DEPARTMENT OF THE INTERIOR • Manuel J. Lujan, Jr., Secretary

BUREAU OF MINES • T S Ary, Director

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The Mineral Industry of Sweden

By Richard H. Singleton[1]

The Swedish economy enjoyed a somewhat improved year in 1987. The gross domestic product (GDP) increased about 2.5% to $158 billion,[2] industrial investment increased 15% to $5.6 billion, industrial production rose 3%, and the jobless rate decreased to 1.9%. The strong trend from traditional heavy industry to high technology and services continued. On the negative side, wages continued to soar, private consumption was up, the rate of inflation increased, and the current-account balance was $1 billion in the red after showing a $1 billion surplus in 1986.

Sweden was dependent on export trade, which increased 5% in 1987 to $44 billion. Imports increased by 10% to $40 billion. Nearly 10% of Sweden's export revenues usually came from the United States, but these decreased 10% in 1987 to $4.3 billion. Imports from the United States also decreased 10%, to $2.6 billion, despite the lower exchange rate for the dollar. More than 50% of Sweden's exports went to the European Community (EC) and about 20% went to Nordic countries.

The minerals industry accounted for approximately 3% of Sweden's GDP. Ninety percent of the value of the $4.2 billion per year industry was metals mining, smelting, and refining. Industrial minerals made up the remaining 10%. Steel billets accounted for about 70% of the value of the metals industry, followed by iron ore, ferrochrome, copper, aluminum, and zinc concentrate, in order of value. An approximate breakdown of the value of the major industrial minerals industries was cement, 30%; aggregate, 30%; and dimension stone, lime, and sulfur, about 10% each.

The value of crude steel production was estimated to be $2.8 billion in 1987, down 2% from the production value for 1986. Although the U.S. Government decided to continue countervailing duties on some Swedish steel, heavy European demand for stainless steel raised specialty steel production. Sweden's specialty steel producers and its integrated carbon steel producer announced plans to upgrade plants for more efficient production to meet unexpected demand.

Production of ferroalloys was down for the second consecutive year, at a value of $234 million in 1987 compared with $288 million in 1986. Production values of refined copper and lead rose for the second consecutive year, by 1% to $147 million for copper and by less than 1% to $46 million for lead. Production of zinc concentrate was relatively unchanged from that of 1986, with a value of $88 million. Boliden Minerals AB, Sweden's largest producer of copper, lead, and zinc concentrates and metal, proposed to expand and improve its mine and smelter productivity, efficiency, and profit. The Government delayed approval of the plans, claiming they conflicted with official policies that favor full employment and elimination of pollution. Gold exploration and mine development became more active.

PRODUCTION AND TRADE

Production of refined primary copper and lead increased significantly for the second successive year while imports of copper concentrate increased. Production of sulfide ores and iron ore from domestic mines decreased slightly. Production of ferrochrome decreased for the second year because of a smelter closure in 1986 coupled with delays in getting a new smelter onstream. No ferrosilicochrome was produced in 1987 because of the 1986 smelter closure. Sweden's output of fluorspar, a byproduct from the country's only tungsten mine, decreased significantly after 1985. Ammonia (nitrogen) output for fertilizer decreased significantly because of a plant closure. Approximately 950,000 tons of metallurgical coal was imported from the United States.

Table 1.—Sweden: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS					
Aluminum:					
Primary	82,156	r82,771	83,509	77,667	81,480
Secondary	17,434	17,557	17,545	18,144	8,820
Arsenic: Trioxide, refined[e]	9,000	10,000	10,000	10,000	10,000
Copper:					
Mine output, Cu content	76,540	r86,898	90,495	87,387	85,016
Metal:					
Smelter:					
Primary	78,756	79,775	74,668	83,358	92,909
Secondary	23,076	22,895	26,017	19,142	12,669
Total smelter	101,832	102,670	100,685	102,500	105,578
Refined:					
Primary	50,141	r56,440	46,997	68,688	80,377
Secondary[e]	13,216	r7,464	17,855	15,773	11,028
Total refined	63,357	63,904	64,852	84,461	91,905
Gold:					
Mine output, Au content	troy ounces	108,300	141,600	148,900	r130,000	e135,000
Metal, primary[3]	do.	77,700	106,200	138,000	r e120,000	e125,000
Iron and steel:					
Iron ore and concentrate:					
Gross weight	thousand tons	14,265	18,123	20,454	20,489	19,707
Fe content	do.	9,270	11,780	13,500	15,520	13,006
Metal:					
Pig iron and sponge iron	do.	2,112	2,223	2,523	2,539	2,419
Ferroalloys:					
Ferrochromium		119,491	134,023	135,453	126,144	109,852
Ferrochromium-silicon		18,377	30,633	26,243	17,024	--
Ferromolybdenum		641	229	161	--	--
Ferrosilicon		19,406	23,278	23,279	19,969	19,949
Ferrotungsten		366	180	--	--	--
Total		158,281	188,343	190,136	163,137	129,801
Steel, crude	thousand tons	4,116	4,705	4,813	4,710	4,606
Semimanufactures, rolled	do.	3,598	3,983	4,254	4,005	e4,000
Lead:						
Mine output, Pb content		85,762	r80,760	75,894	88,903	90,423
Metal:						
Smelter:						
Primary:						
Crude		28,025	15,978	15,585	6,512	1,439
Refined		34,780	49,758	48,221	49,160	61,229
Total primary		60,805	65,636	58,756	55,672	62,668
Secondary		15,170	27,737	25,861	27,783	30,185
Total smelter		75,975	93,373	84,617	83,455	92,853

See footnotes at end of table.

Table 1.—Sweden: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986	1987[p]
METALS —Continued					
Lead —Continued					
Metal —Continued					
Refined:					
Primary	34,780	49,758	43,222	49,160	61,229
Secondary	15,170	27,737	25,861	27,783	30,185
Total refined	49,950	77,496	69,082	76,943	91,414
Molybdenum, oxide, roasted, Mo content	1,698	1,064	1,486	2,170	2,121
Selenium, elemental, refined	42	68	46	r e50	e50
Silicon metal	20,340	20,206	19,755	e20,000	e20,000
Silver:					
Mine output, Ag content thousand troy ounces	6,655	7,676	7,442	7,555	6,912
Metal, primary[2] do.	5,284	r5,370	5,073	r e5,250	e4,800
Tungsten, mine output, W content	365	385	462	357	334
Zinc, mine output, Zn content	r216,606	r210,037	216,403	219,289	218,570
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	2,240	2,393	2,124	2,119	e2,200
Clays: Kaolin	305	196	106	60	e100
Feldspar, salable, crude and ground	52,913	49,833	41,720	35,160	52,000
Fluorspar concentrate	2,042	3,454	3,169	265	220
Kyanite	--	--	2,200	e5,000	e5,000
Lime, mostly quicklime thousand tons	610	648	649	656	e650
Nitrogen: N content of ammonia do.	49	49	18	46	e45
Phosphate rock (byproduct):					
Gross weight do.	197	133	187	192	221
P_2O_5 content do.	41	51	71	71	82
Pyrite, gross weight do.	430	418	407	447	429
Quartz	13,041	17,589	17,296	e17,000	e17,000
Sodium sulfate[3] thousand tons	100	100	100	100	100
Stone:					
Dimension, mostly unfinished:					
Granite do.	r128	r138	148	169	e175
Limestone do.	15	15	15	e15	e15
Sandstone do.	3	4	3	e3	e3
Slate do.	29	22	21	21	e20
Crushed:					
Dolomite do.	645	r830	963	780	e800
Granite do.	9,892	9,873	8,060	6,888	e7,000
Limestone:					
For cement manufacture do.	r796	r842	765	913	e900
For lime manufacture do.	759	687	1,997	r e2,000	e2,000
For other construction and industrial uses do.	2,117	2,039	2,068	r e2,100	e2,000
Chalk (ground) do.	38	40	40	39	e40
Marl do.	2,717	2,718	2,314	r e2,500	e2,500
For agricultural uses (ground) do.	r307	r296	306	300	e300
For other uses (ground) do.	67	108	94	e100	e100
Total do.	r6,801	r6,730	7,584	7,952	e7,940
Quartzite do.	1,297	1,533	1,466	7,128	e1,500
Sandstone do.	140	138	123	r e125	e125
Other do.	610	666	630	r e700	e700
Sulfur:					
S content of pyrite do.	r219	r212	210	227	e220
Byproduct:					
From metallurgy do.	114	122	123	125	e130
From petroleum do.	20	26	23	49	e50
Total do.	353	r360	356	401	e400
Sulfuric acid do.	928	930	960	1,001	e1,000
Talc and steatite	21,066	17,882	14,400	2,000	800
MINERAL FUELS AND RELATED MATERIALS					
Carbon black thousand tons	24	26	31	r e30	e30
Coke, metallurgical do.	1,159	1,226	1,247	e1,200	e1,200
Peat, for agricultural use[3] do.	60	60	60	60	60

See footnotes at end of table.

Table 1.—Sweden: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity		1983	1984	1985	1986	1987[p]
MINERAL FUELS AND RELATED MATERIALS — Continued						
Petroleum:						
Crude	thousand 42-gallon barrels	172	98	40	30	24
Refinery products:						
Liquefied petroleum gas	do.	1,299	1,891	2,088	2,714	2,448
Naphtha	do.	1,640	1,700	1,096	1,530	1,726
Gasoline, motor	do.	21,326	27,931	25,466	26,868	[e]31,118
Jet fuel	do.	2,256	3,784	4,112	3,544	[e]4,704
Kerosene	do.	155	116	202	170	[e]256
Distillate fuel oil	do.	35,219	34,127	34,480	40,761	41,552
Residual fuel oil	do.	36,167	27,999	27,206	28,025	26,207
Other	do.	4,129	4,853	5,252	5,485	5,972
Refinery fuel and losses	do.	4,988	5,175	8,010	6,630	7,448
Total	do.	107,169	107,586	107,912	115,727	[e]121,331

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through July 30, 1988.

[2]Includes only that recovered from indigenous ores excluding scrap.

Table 2.—Sweden: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	541	--		
Oxides and hydroxides	513	8,304	NA	Norway 8,017.
Metal including alloys:				
Scrap	8,699	13,434	17	Finland 5,327; West Germany 4,247; Denmark 1,170.
Unwrought	41,816	39,353	--	West Germany 19,025; United Kingdom 5,017; Netherlands 4,183.
Semimanufactures	48,726	55,961	1,876	Denmark 11,071; United Kingdom 9,416; Norway 6,770.
Antimony: Metal including alloys, all forms	[r]	25	--	All to Netherlands.
Cadmium: Metal including alloys, all forms	15	--		
Chromium:				
Ore and concentrate	13	36	--	All to Norway.
Oxides and hydroxides	29	--		
Metal including alloys, all forms	4	--		
Cobalt:				
Oxides and hydroxides	[r]	--		
Metal including alloys, all forms	125	78	3	Brazil 14; France 13; United Kingdom 13.
Columbium and tantalum: Metal including alloys, all forms, tantalum	[r]	--		
Copper:				
Ore and concentrate	108,707	83,164	--	Finland 42,207; Norway 19,510; West Germany 10,887.
Oxides and hydroxides	2	--		
Sulfate	45	--		
Ash and residue containing copper	5,892	7,439	--	Belgium-Luxembourg 6,318; France 1,100.
Metal including alloys:				
Scrap	3,624	4,866	--	Denmark 3,438; Poland 730; Finland 184.
Unwrought	54,207	58,648	73	United Kingdom 26,855; Belgium-Luxembourg 18,229; West Germany 7,994.
Semimanufactures	75,616	81,867	100	Norway 9,618; United Kingdom 8,249.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Gold:				
Waste and sweepings value, thousands	$2,977	$13,542	NA	United Kingdom $6,463; West Germany $5,135; Switzerland $1,523.
Metal including alloys, unwrought and partly wrought do.	$50,966	$50,740	NA	NA.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	18,302	17,219	136	West Germany 4,597; Belgium-Luxembourg 2,902; France 2,407.
Pyrite, roasted do.	(*)	1	--	Mainly to United Kingdom.
Metal:				
Scrap	21,631	28,585	1	Italy 11,275; Spain 5,162; Netherlands 3,190.
Pig iron, cast iron, related materials	108,202	113,674	3,796	West Germany 15,998; Japan 15,728; United Kingdom 10,209.
Ferroalloys:				
Ferrochromium	103,121	85,276	NA	NA.
Ferromanganese	1,167	2,009	NA	United Kingdom 1,586; Turkey 247; Hungary 80.
Ferromolybdenum	101	58	NA	Vietnam 10; Norway 9; Finland 8.
Ferronickel	3	--	--	
Ferrosilicochromium	2,226	2,073	NA	West Germany 1,211; U.S.S.R. 701; Japan 100.
Ferrosilicomanganese	65	464	NA	United Kingdom 412.
Ferrosilicon	21,416	11,480	NA	NA.
Unspecified	343	265	58	Finland 47; United Kingdom 31.
Steel, primary forms	761,582	694,316	354,016	West Germany 84,604; Italy 78,543.
Semimanufactures:				
Bars, rods, angles, shapes, sections	867,257	807,406	62,610	West Germany 207,738; Denmark 89,910; United Kingdom 89,119.
Universals, plates, sheets	991,546	981,394	80,551	West Germany 164,462; Denmark 140,110; Norway 113,466.
Hoop and strip	130,237	126,615	13,802	West Germany 27,136; Denmark 18,744.
Rails and accessories	41,241	21,259	485	Norway 12,360; United Kingdom 3,734; India 1,914.
Wire	67,261	65,128	8,592	West Germany 11,439; Finland 7,283.
Tubes, pipes, fittings	243,321	224,712	25,108	West Germany 38,913; France 21,419.
Castings and forgings, rough	3,016	4,821	7	Norway 2,117; Finland 1,290; Denmark 419.
Lead:				
Ore and concentrate	42,962	58,048	--	West Germany 31,269; Belgium-Luxembourg 18,780; U.S.S.R. 3,200.
Oxides	146	--		
Metal including alloys:				
Scrap	165	573	--	Denmark 540; Cyprus 32.
Unwrought	64,772	65,688	3,014	Norway 11,654; Denmark 8,427; West Germany 8,257.
Semimanufactures	404	594	(*)	United Kingdom 378; Denmark 134; Norway 53.
Magnesium: Metal including alloys:				
Scrap	674	864	50	West Germany 438; Netherlands 147; Denmark 56.
Unwrought	1	(*)	--	All to United Kingdom.
Semimanufactures	221	66	NA	Denmark 16; Norway 2; unspecified 48.
Manganese:				
Ore and concentrate, metallurgical-grade	24	--		
Oxides	1	--		
Metal including alloys, all forms	86	113	NA	Finland 62; Norway 28.
Mercury 76-pound flasks	--	319	NA	NA.
Molybdenum:				
Ore and concentrate	1,375	1,687	--	Netherlands 1,474; Finland 145; West Germany 65.
Oxides and hydroxides	42	--		
Metal including alloys, all forms	118	6	NA	NA.
Nickel: Metal including alloys:				
Scrap	533	648	10	West Germany 250; United Kingdom 153; Netherlands 140.
Unwrought	96	52	--	Netherlands 33; United Kingdom 11; Finland 3.
Semimanufactures	1,476	1,361	346	West Germany 197; Italy 125.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$1,248	$1,962	$27	Netherlands $947; Norway $225; United Kingdom $200.
Silicon, high-purity do.	$20,141	$23,879	NA	NA.
Silver:				
Ore and concentrate[3] do.	$70	--		
Waste and sweepings[3] do.	$15,222	$18,733	$2,588	United Kingdom $5,941; West Germany $4,784; Norway $3,565.
Metal including alloys, unwrought and partly wrought thousand troy ounces	6,334	9,099	--	Finland 514; unspecified 8,520.
Tin: Metal including alloys:				
Scrap	1	1	--	Mainly to Finland.
Unwrought	169	118	--	Norway 53;Denmark 43; Finland 22.
Semimanufactures	154	136	--	Denmark 78; Norway 53; Finland 4.
Titanium:				
Ore and concentrate	5	--		
Oxides	77	--		
Metal including alloys, all forms	188	189	50	United Kingdom 138.
Tungsten:				
Ore and concentrate	193	394	--	All to West Germany.
Metal including alloys, all forms	194	52	NA	United Kingdom 38; West Germany 6.
Zinc:				
Ore and concentrate	426,511	437,096	--	France 84,106; Norway 79,226; Finland 79,019.
Oxides	484	525	NA	West Germany 252; Norway 196.
Blue powder	14	--		
Ash and residue containing zinc	33,061	23,144	--	Norway 18,316; Belgium-Luxembourg 3,943; West Germany 896.
Metal including alloys:				
Scrap	2,487	2,877	--	Norway 1,016; West Germany 698; United Kingdom 277.
Unwrought	1,104	973	495	Denmark 219; Norway 209.
Semimanufactures	28	84	--	West Germany 16; Norway 6; Finland 4.
Zirconium:				
Ore and concentrate	30	--		
Metal including alloys, all forms	15	21	--	All to United Kingdom.
Other:				
Oxides and hydroxides	25	84	NA	Norway 49; West Germany 30.
Ashes and residues	9,553	5,175	--	Netherlands 1,076; East Germany 358; United Kingdom 321.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	49	243	--	Finland 236; Austria 1; Norway 1.
Artificial:				
Corundum	43	44	NA	NA.
Silicon carbide	416	91	NA	NA.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$31	$5	--	Finland $1; Norway $1; Switzerland $1.
Grinding and polishing wheels and stones	1,940	2,011	1	U.S.S.R. 543; France 265; United Kingdom 264.
Barite and witherite	4	--		
Boron materials:				
Crude natural borates	--	1	--	All to Norway.
Oxides and acids	20	--		
Cement	655,665	548,694	NA	NA.
Chalk	8,868	8,329	--	Finland 4,132; Norway 2,721; Denmark 1,056.
Clays, crude:				
Bentonite	90	--		
Kaolin	4,466	1,552	--	Finland 1,261.
Unspecified	4,566	5,191	--	Norway 2,912; Italy 1,226; West Germany 173.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Diamond:				
Gem, not set or strung value, thousands	$2,545	$1,825	$17	Belgium-Luxembourg $669; Finland $503; Denmark $304.
Industrial stones do.	874	$49	--	United Kingdom $23; Netherlands $17; Argentina $6.
Diatomite and other infusorial earth	611	47	--	Norway 32; Finland 4; Israel 3.
Feldspar, fluorspar, related materials:				
Fluorspar	4,939	557	NA	Finland 411.
Unspecified	21,868	22,273	NA	United Kingdom 12,081; East Germany 4,100; Austria 2,483.
Fertilizer materials:				
Crude, n.e.s	1,006	1,266	--	West Germany 492; Norway 425; United Kingdom 145.
Manufactured:				
Ammonia	609	912	NA	Norway 882.
Nitrogenous	243,508	260,134	--	NA.
Phosphatic	69,827	63,963	--	NA.
Potassic	4	--	--	
Unspecified and mixed	201,612	201,656	--	NA.
Graphite, natural	128	5	--	Mozambique 2; Norway 2; Denmark 1.
Gypsum and plaster	377	290	--	NA.
Lime	18,699	17,309	NA	Denmark 8,072; Norway 4,895; Netherlands 2,085.
Magnesium compounds	1,869	575	--	Norway 468; Finland 19; Republic of Korea 7.
Mica:				
Crude including splittings and waste	20	46	--	West Germany 43.
Worked including agglomerated splittings	3	1	NA	NA.
Phosphates, crude	98,428	132,725	--	Norway 86,751; Denmark 32,611; West Germany 3,853.
Pigments, mineral: Iron oxides and hydroxides, processed	971	286	NA	NA.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$6,862	$5,609	--	Belgium-Luxembourg $4,593; Denmark $521; Switzerland $237.
Synthetic do.	$25,762	$24,718	--	Ireland $24,250; Finland $365; West Germany $2.
Pyrite, unroasted	30	14	--	Venezuela 10; Thailand 4.
Salt and brine	2,063	1,835	--	Norway 662; Denmark 456; Belgium-Luxembourg 369.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	255	305	NA	NA.
Sulfate, manufactured	90,938	99,004	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	191	172	1	West Germany 63; Italy 34; Denmark 24.
Worked do.	20	20	(*)	Denmark 10; Norway 5; West Germany 2.
Dolomite, chiefly refractory-grade do.	36	39	--	Denmark 9; Netherlands 9; Norway 9.
Gravel and crushed rock do.	1,607	1,611	--	Denmark 769; West Germany 601; United Kingdom 105.
Limestone other than dimension do.	845	857	--	Finland 748; Denmark 90; West Germany 11.
Quartz and quartzite do.	424	298	(*)	Norway 255; Denmark 6; West Germany 2.
Sand other than metal-bearing do.	117	112	--	Norway 54; Denmark 50; West Germany 7.
Sulfur:				
Elemental:				
Crude including native and by-product	1,502	10,246	--	United Kingdom 9,079; Finland 1,161; Netherlands 6.
Colloidal, precipitated, sublimed	25	9,286	--	France 9,285.
Dioxide	34,690	24,973	NA	Finland 14,274; West Germany 4,810; Norway 2,679.
Sulfuric acid	21,645	244,248	34,737	Netherlands 110,608; Belgium-Luxembourg 59,705.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Talc, steatite, soapstone, pyrophyllite	12,305	9,144	--	Netherlands 4,585; Denmark 1,158; Norway 1,116.
Other:				
Crude	6,530	6,195	(2)	Norway 3,921; Denmark 1,620; Finland 190.
Slag and dross, not metal-bearing	106,502	88,111	(2)	United Kingdom 36,724; Finland 23,880; Republic of South Africa 20,072.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1	9	--	East Germany 5; Denmark 2; Norway 1.
Carbon black	16,963	18,149	NA	Poland 5,804; Denmark 2,628; East Germany 2,559.
Coal:				
Anthracite	--	2,178	--	Ireland 2,173.
Bituminous	112,014	55,221	--	Ireland 46,664; United Kingdom 4,200; Norway 1,446.
Coke and semicoke	77,189	141,863	--	Finland 110,329; West Germany 11,477; Norway 11,418.
Peat including briquets and litter	36,763	51,090	--	Norway 25,381; Denmark 13,320; Netherlands 9,428.
Petroleum:				
Crude, thousand 42-gallon barrels	689	974	--	France 876; United Kingdom 98.
Refinery products:				
Liquefied petroleum gas value, thousands	$24,047	$18,207	$3,818	United Kingdom $6,020; France $2,902.
Gasoline thousand 42-gallon barrels	7,761	8,942	--	Denmark 3,402; Norway 2,772; West Germany 1,589.
Mineral jelly and wax do.	1	3	(2)	Norway 2.
Kerosene and jet fuel do.	963	417	--	Denmark 323; Norway 88; India 4.
Distillate fuel oil do.	16,251	17,059	--	Denmark 7,002; West Germany 5,279; Norway 1,473.
Lubricants do.	1,136	1,248	(2)	Norway 356; Netherlands 255; United Kingdom 201.
Residual fuel oil do.	13,588	16,006	936	United Kingdom 4,872; Belgium-Luxembourg 3,234; Denmark 2,523.
Bitumen and other residues do.	1,773	1,783	--	Norway 863; Denmark 513; Finland 181.
Bituminous mixtures do.	56	56	8	Belgium-Luxembourg 9; Finland 6.
Petroleum coke do.	(2)	--		

NA Not available.
[1]Table prepared by Josef Plachy.
[2]Less than 1/2 unit.
[3]May include other precious metals.

Table 3.—Sweden: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	52,073	50,056	--	West Germany 16,622; Netherlands 12,657; France 9,568.
Oxides and hydroxides	242,730	197,583	33	Venezuela 62,147; West Germany 42,934; Jamaica 31,511.
Metal including alloys:				
Scrap	1,507	1,621	(2)	Norway 671; United Kingdom 510; Denmark 252.
Unwrought	46,265	54,269	3	Norway 23,887; Canada 17,582; Finland 2,646.
Semimanufactures	77,341	86,279	549	West Germany 28,408; Norway 8,240; France 7,240.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Antimony: Metal including alloys, all forms	23	--		
Arsenic: Metal including alloys, all forms	930	--		
Beryllium: Metal including alloys, all forms	(2)	(2)	(2)	
Cadmium: Metal including alloys, all forms	280	201	--	Finland 141; Norway 60.
Chromium:				
Ore and concentrate	287,240	287,876	NA	NA.
Oxides and hydroxides	987	791	(2)	Poland 481; West Germany 257; United Kingdom 68.
Metal including alloys, all forms	248	322	NA	United Kingdom 258; France 62.
Cobalt:				
Oxides and hydroxides	8	10	7	Netherlands 2.
Metal including alloys, all forms	488	433	51	Zambia 149; Belgium-Luxembourg 91.
Columbium and tantalum: Metal including alloys, all forms, tantalum	1	1	NA	Mainly from United Kingdom.
Copper:				
Ore and concentrate	106,474	48,571	--	Chile 20,220; Norway 14,941; Philippines 3,447.
Matte and speiss including cement copper	5,042	7,012	--	France 6,982; Finland 129.
Oxides and hydroxides	758	698	NA	Yugoslavia 201; West Germany 142; Australia 110.
Sulfate	997	880	NA	U.S.S.R. 417; Czechoslovakia 170; Israel 160.
Ash and residue containing copper	22,902	29,276	6,689	West Germany 18,764; United Kingdom 2,722.
Metal including alloys:				
Scrap	21,275	10,831	2,715	United Kingdom 2,688; France 2,044.
Unwrought	61,247	62,245	15	West Germany 9,606; Canada 8,971; Zambia 8,523.
Semimanufactures	41,017	42,545	100	West Germany 18,002; West Germany 18,002; United Kingdom 5,616; Belgium-Luxembourg 4,919.
Gold:				
Waste and sweepings value, thousands	$620	$433	--	Denmark $187; Finland $171; Norway $75.
Metal including alloys, unwrought and partly wrought ...do...	$6,014	$12,269	$114	West Germany $6,465; United Kingdom $3,539; Switzerland $292.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	67,950	67,712	--	Norway 67,266; Netherlands 225; United Kingdom 221.
Pyrite, roasted	6,869	--		
Metal:				
Scrap	884,890	698,256	11,662	United Kingdom 271,197; U.S.S.R. 195,220; West Germany 73,764.
Pig iron, cast iron, related materials	56,639	65,804	227	U.S.S.R. 20,477; Canada 13,448; Brazil 10,759.
Ferroalloys:				
Ferrochromium	52,006	42,967	156	Finland 13,820; Republic of South Africa 12,747; U.S.S.R. 5,665.
Ferromanganese	28,406	26,464	--	Norway 16,918; Republic of South Africa 5,186; France 2,986.
Ferromolybdenum	1,377	1,388	62	Austria 266; Spain 243; United Kingdom 221.
Ferronickel	7,317	13,403	41	New Caledonia 6,205; Greece 2,786; Dominican Republic 2,504.
Ferrosilicochromium	1,645	100	--	U.S.S.R. 99.
Ferrosilicomanganese	15,696	17,589	--	Norway 11,997; Republic of South Africa 2,961; Czechoslovakia 1,854.
Ferrosilicon	21,251	17,177	--	Norway 15,514; France 621; West Germany 551.
Unspecified	3,710	4,603	551	U.S.S.R. 527; West Germany 792; United Kingdom 616.
Steel, primary forms	71,030	94,730	1,345	West Germany 44,898; United Kingdom 20,142; Japan 10,704.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	413,200	415,182	1,391	West Germany 94,275; United Kingdom 56,745; Finland 46,548.
Universals, plates, sheets	799,459	807,962	32	West Germany 214,256; Belgium-Luxembourg 177,718; France 108,795.
Hoop and strip	133,085	135,265	91	West Germany 55,800; United Kingdom 15,597; Finland 13,407.
Rails and accessories	4,008	4,216	--	United Kingdom 2,196; West Germany 931; Austria 401.
Wire	31,177	30,913	47	Belgium-Luxembourg 9,545; Finland 5,253; France 5,152.
Tubes, pipes, fittings	317,184	309,121	114	West Germany 66,264; Finland 62,189; United Kingdom 41,728.
Castings and forgings, rough	10,916	9,165	2	Denmark 2,662; Norway 2,510; West Germany 1,934.
Lead:				
Ore and concentrate	6,592			
Oxides	3,905	4,397	6	West Germany 2,737; France 513; United Kingdom 882.
Metal including alloys:				
Scrap	20,680	16,469	43	Norway 6,586; Finland 4,606; Denmark 3,891.
Unwrought	4,811	5,025	--	United Kingdom 2,842; Denmark 332; West Germany 180.
Semimanufactures	1,092	1,221	1	West Germany 1,036; Netherlands 138; United Kingdom 113.
Magnesium: Metal including alloys:				
Scrap	1			
Unwrought	1,688	1,840	62	Norway 1,771; United Kingdom 6.
Semimanufactures	111	132	5	Norway 45; West Germany 35; Switzerland 21.
Manganese:				
Ore and concentrate, metallurgical-grade	356	12,097	--	Brazil 11,975; Netherlands 102; France 17.
Oxides	255	227	202	West Germany 14; Finland 5.
Metal including alloys, all forms	1,073	1,726	NA	Republic of South Africa 860; France 705; China 121.
Mercury ——— 76-pound flasks	464	1,363	--	Algeria 349; Yugoslavia 290; U.S.S.R. 261.
Molybdenum:				
Ore and concentrate	6,481	7,246	3,008	Chile 2,270; Netherlands 868.
Oxides and hydroxides	125	96	--	West Germany 86; Chile 10.
Metal including alloys, all forms	137	169	19	West Germany 130; Austria 12.
Nickel:				
Ore and concentrate	--	19	--	All from Australia.
Matte and speiss	2,603	3,513	--	Do.
Metal including alloys:				
Scrap	5,679	6,089	1,948	West Germany 2,319; United Kingdom 1,430.
Unwrought	12,284	10,343	611	United Kingdom 2,836; Canada 2,397; Republic of South Africa 1,043.
Semimanufactures	1,113	862	97	United Kingdom 490; West Germany 117.
Platinum-group metals: Metals including alloys, unwrought and partly wrought ——— value, thousands	$29,216	$42,255	$9,291	Switzerland $17,438; United Kingdom $8,511.
Selenium, elemental	41	9	NA	Finland 5.
Silicon, high-purity and metal	397	630	NA	France 309; Norway 304; West Germany 22.
Silver:				
Ore and concentrate[2] value, thousands	$29,134	$29,970	$4,057	Peru $12,179; Chile $6,606.
Waste and sweepings[3] ——— do.	$4,692	$9,015	$6,233	Finland $1,450; France $836.
Metal including alloys, unwrought and partly wrought thousand troy ounces	5,370	5,562	22	West Germany 2,572; France 1,382; United Kingdom 643.
Tin: Metal including alloys:				
Scrap	87	58	--	Denmark 45; Finland 9; Norway 3.
Unwrought	577	643	(4)	United Kingdom 259; Malaysia 191; West Germany 68.
Semimanufactures	123	130	(4)	Netherlands 58; West Germany 41; United Kingdom 27.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Source: 1986	
			United States	Other (principal)
METALS —Continued				
Titanium:				
Ore and concentrate	4,636	22,656	NA	Australia 22,581.
Oxides	4,861	5,089	195	Norway 2,068; Finland 878; West Germany 616.
Metal including alloys, all forms	45	38	24	United Kingdom 5; West Germany 4.
Tungsten:				
Ore and concentrate	1,150	1,351	--	Australia 406; France 275; Canada 216.
Oxides and hydroxides	7	--	--	
Metal including alloys, all forms	42	212	5	Israel 115; United Kingdom 29; West Germany 23.
Zinc:				
Ore and concentrate	5	--	--	
Oxides	1,321	1,664	--	West Germany 521; United Kingdom 409; Netherlands 347.
Blue powder	288	294	--	Norway 265; West Germany 23.
Ash and residue containing zinc	29,246	21,286	5,515	West Germany 12,419; United Kingdom 1,970.
Metal including alloys:				
Scrap	96	192	--	Norway 100; Denmark 84.
Unwrought	35,188	35,943	--	Norway 18,068; Finland 14,026; Poland 1,138.
Semimanufactures	193	233	(2)	West Germany 127; Norway 46; Poland 32.
Zirconium:				
Ore and concentrate	3,113	4,269	NA	Netherlands 643; Republic of South Africa 500.
Metal including alloys, all forms	128	193	36	France 140; United Kingdom 11.
Other:				
Oxides and hydroxides	728	787	67	United Kingdom 317; Belgium-Luxembourg 215.
Ashes and residues	13,784	13,334	755	Norway 7,458; West Germany 1,685; France 973.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	2,933	1,172	2	Italy 387; Greece 274; West Germany 271.
Artificial:				
Corundum	6,116	5,910	542	West Germany 3,625; Hungary 526; United Kingdom 511.
Silicon carbide	6,470	4,960	NA	Norway 3,568; West Germany 939; Netherlands 322.
Dust and powder of precious and semiprecious stones including diamond	value, thousands	$3,583	$3,633	$71	Ireland $2,789; Switzerland $394; Netherlands $209.
Grinding and polishing wheels and stones	2,954	2,715	76	Austria 1,0[illegible]; West Germany 497; Fra[illegible]274.
Asbestos, crude	1,042	1,069	--	All from Canada.
Barite and witherite	5,606	6,894	--	West Germany 6,035; China 329; United Kingdom 152.
Boron materials:				
Crude natural borates	14,718	13,807	4,280	Turkey 8,826; Netherlands 701.
Elemental	1	NA		
Oxides and acids	897	772	74	France 304; Turkey 183.
Cement	200,025	207,609	34	East Germany 106,292; U.S.S.R. 75,467; Denmark 16,045.
Chalk	25,972	23,148	13	West Germany 10,146; Denmark 5,739; Norway 4,164.
Clays, crude:				
Bentonite	6,096	9,226	62	Cyprus 4,340; United Kingdom 3,973; West Germany 445.
Kaolin	419,400	396,492	28,103	United Kingdom 290,516; Czechoslovakia 15,067.
Unspecified	39,280	35,603	2,500	United Kingdom 20,362; West Germany 5,249; Czechoslovakia 3,364.
Cryolite and chiolite	1,110	170	--	Denmark 169; Norway 1.
Diamond:				
Gem, not set or strung	value, thousands	$9,853	$7,977	$49	Belgium-Luxembourg $4,254; Israel $1,051; United Kingdom $846.
Industrial stones	do.	$753	$809	$21	United Kingdom $193; Netherlands $169; Belgium-Luxembourg $68.
Diatomite and other infusorial earth	2,826	2,256	653	Denmark 769; Iceland 201.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Feldspar, fluorspar, related materials:				
Fluorspar	9,929	10,648	--	Mexico 8,090; East Germany 1,343; United Kingdom 708.
Unspecified	11,860	13,392	--	Norway 12,154; Finland 884; West Germany 334.
Fertilizer materials:				
Crude, n.e.s	44	23	--	All from West Germany.
Manufactured:				
Ammonia	277,932	196,056	12,943	U.S.S.R. 110,950; Poland 51,079; West Germany 14,127.
Nitrogenous	591,314	587,667	NA	Norway 385,279; West Germany 58,439; unspecified 70,898.
Phosphatic	52	1,532	--	All from Belgium-Luxembourg.
Potassic	$16,634	$16,894	$230	West Germany $11,520; France $2,208; U.S.S.R. $1,540.
Unspecified and mixed	307,013	262,066	100	Norway 169,586; Netherlands 26,123; West Germany 20,932.
Graphite, natural	743	570	22	West Germany 299; United Kingdom 149; China 90.
Gypsum and plaster	290,109	291,701	121	Norway 169,586; Netherlands 26,123; West Germany 20,932.
Lime	7,519	3,473	--	West Germany 1,116; Denmark 1,021; Finland 1,016.
Magnesium compounds	28,126	23,453	122	China 8,087; Greece 2,800; United Kingdom 2,594.
Mica:				
Crude including splittings and waste	447	399	--	Norway 117; United Kingdom 87; India 72.
Worked including agglomerated splittings	76	90	(2)	Switzerland 55; Austria 11; Belgium-Luxembourg 11.
Nitrates, crude	4,600	4,023	--	All from Chile.
Phosphates, crude	749,688	588,417	81,802	U.S.S.R. 279,406; Morocco 196,334.
Phosphorus, elemental	28	26	--	All from West Germany.
Pigments, mineral: Iron oxides and hydroxides, processed	6,323	4,209	5	West Germany 3,406; Spain 316; United Kingdom 268.
Potassium salts, crude	2,175	2,099	--	All from West Germany.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$4,216	$1,964	$250	Thailand $691; West Germany $384; Switzerland $318.
Synthetic do.	$2,197	$2,124	$1,792	Finland $57; Switzerland $50.
Pyrite, unroasted	21,970	48,807	--	Norway 38,384; Finland 10,253; West Germany 166.
Salt and brine thousand tons	1,256	1,269	(2)	West Germany 390; Netherlands 300; Denmark 140.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	106,443	95,318	15,928	East Germany 38,840; West Germany 26,025.
Sulfate, manufactured	19,454	19,232	NA	East Germany 8,697; United Kingdom 4,586; Belgium-Luxembourg 3,119.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	5,189	6,908	(2)	Finland 2,500; Norway 1,919; India 1,219.
Worked	10,751	13,362	--	Portugal 6,593; Italy 3,770; Finland 698.
Dolomite, chiefly refractory-grade	137,195	150,078	--	United Kingdom 60,266; Belgium-Luxembourg 47,455; Norway 37,006.
Gravel and crushed rock	70,091	73,751	6	Norway 35,219; Denmark 11,334; Finland 10,722.
Limestone other than dimension	51,538	51,659	--	Denmark 26,562; Norway 14,780; United Kingdom 8,565.
Quartz and quartzite	59,133	63,517	28	Spain 59,156; West Germany 1,909; Finland 1,680.
Sand other than metal-bearing	379,303	286,944	32	Denmark 141,378; Belgium-Luxembourg 119,925; United Kingdom 19,252.
Sulfur:				
Elemental:				
Crude including native and by-product	6,318	8,465	--	Poland 5,902; Norway 2,179; West Germany 237.
Colloidal, precipitated, sublimed	12,004	9,898	--	Poland 9,836; West Germany 62.
Dioxide	11,733	8,813	--	Norway 8,812.
Sulfuric acid	28,501	1,404	(3)	Norway 1,148; West Germany 226.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Talc, steatite, soapstone, pyrophyllite	26,349	27,263	55	Finland 12,449; Norway 6,847; Belgium-Luxembourg 4,205.
Other:				
Crude	220,773	153,709	230	Norway 106,980; West Germany 2,330; France 8[e].
Slag and dross, not metal-bearing	32,597	32,392	22	West Germany 9,225; Netherlands 8,931; Norway 7,807.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	653	749	246	Trinidad and Tobago 435; West Germany 40.
Carbon black	12,147	14,271	414	West Germany 7,250; Netherlands 5,592; United Kingdom 889.
Coal:				
Anthracite thousand tons	30	19	--	China 10; Belgium-Luxembourg 8.
Bituminous do.	4,804	4,414	1,160	Australia 1,215; Poland 1,062.
Briquets of anthracite and bituminous coal do.	[e]	1	--	All from West Germany.
Lignite including briquets do.	3	3	--	East Germany 2; West Germany 1.
Coke and semicoke do.	382	365	36	Japan 79; Australia 36.
Peat including briquets and litter	24,231	49,600	--	Finland 41,019; United Kingdom 4,653; U.S.S.R. 3,572.
Petroleum:				
Crude thousand 42-gallon barrels	101,260	116,487	--	United Kingdom 47,693; Norway 24,501; U.S.S.R. 9,086.
Refinery products:				
Liquefied petroleum gas do.	4,045	8,397	--	Denmark 2,165; Norway 1,903; United Kingdom 1,463.
Gasoline do.	20,264	21,293	25	United Kingdom 4,526; Finland 3,741; Denmark 3,601.
Mineral jelly and wax do.	112	116	1	West Germany 71; United Kingdom 13; Hungary 10.
Kerosene and jet fuel do.	1,959	2,746	[e]	Netherlands 754; Finland 593; United Kingdom 527.
Distillate fuel oil do.	21,857	21,195	1,459	U.S.S.R. 4,747; Denmark 4,248; East Germany 3,958.
Lubricants do.	2,029	1,714	21	Netherlands 437; United Kingdom 433; West Germany 254.
Residual fuel oil do.	[illegible]	23,714	--	U.S.S.R. 6,269; United Kingdom 4,923; Netherlands 2,963.
Bitumen and other residues do.	243	667	NA	Mainly from Finland.
Bituminous mixtures do.	82	31	1	Finland 12; France 8; United Kingdom 3.
Petroleum coke do.	279	750	317	United Kingdom 164; Belgium-Luxembourg 143.

NA Not available.
[1]Table prepared by Josef Plachy.
[e]Less than 1/2 unit.
[e]May include other precious metals.

COMMODITY REVIEW

METALS

Copper.—Boliden, Sweden's largest producer of copper concentrate and its only producer of copper metal, at its Ronnskar smelter, proposed in September a comprehensive $500 million plan to expand its copper-zinc-lead mining operations in northern Sweden to help ensure a constant supply of raw material for its smelter into the next century. Reserves were depleting rapidly; the Aitik Mine, which supplied nearly one-half of Sweden's copper concentrate, had reserves sufficient for only 10 to 15 years and the Näsliden copper-zinc mine in the Kristineberg district was exhausted and closed. Boliden sought significant Government financial support for its plan. The Government officials disagreed with Boliden's optimistic estimate of the higher employment after the expansion, and they said Boliden's mining and smelting operations both caused serious pollution problems. Boliden was appealing at yearend stringent

proposed environmental regulations, particularly because meeting them would significantly curtail copper and lead output from the Ronnskar smelter. The company at midyear had revealed a $10 million program to keep its smelter open while it reduced sulfur dioxide (SO_2) emissions by 50%. The plan was to close several outdated copper and lead production lines as well as sulfuric acid and liquefied SO_2 plants. Except for sulfur dioxide, production levels would be maintained through efficiency improvements and capacity increases in the newer lines and plants. Boliden continued to send its zinc concentrate to Norway's Norzinc A/S plant for smelting. Boliden was one-half owner of Norzinc.

Ferroalloys.—Swedechrome AB began production of ferrochrome in its new plasma arc smelter at Malmö in October. One of the two furnaces operated continuously during the fourth quarter at somewhat below its 40,000-ton-per-year capacity. Operational difficulties in the subsystems not related to the basic plasma reduction process had prevented the smelter from going on-stream earlier in the year. It did not approach full capacity by yearend as planned. A small amount of ferrochrome was made early in the year, but continuous production could not be maintained at that time. The company declared force majeure at midyear on its deliveries.

Gold.—Boliden expanded gold production in three mines in northern Sweden at a cost of about $4 million per mine; these were two copper-zinc mines, Kristineberg and Renstrom, that produced byproduct gold, and Enåsen, a gold mine with copper and silver byproducts. Näsliden, a copper-zinc mine with byproduct gold, was closed. Loussavaara Kiirunavaara AB (LKAB), Sweden's major iron ore producer, conducted exploratory drilling for gold near Falun in central Sweden after completing seismic exploration during 1986. Terra Mining AB began developing, near Skelleftea in northern Sweden, a gold deposit that was reputed to contain about 300,000 troy ounces of gold.

Iron Ore.—The Swedish Government purchased at yearend the Grängesberg Mine from Svenskt Stål (SSAB) for 1 krona. The deal was made retroactive to January 1 so that the financial loss incurred during the year could be transferred to the state. Government aid was an unacceptable means of keeping the mine in the company's hands because it would inhibit SSAB's exports of steel products to the United States. The Swedish Ministry of Industry guaranteed it would keep the mine operating until 1991, mostly to continue worker employment. SSAB had declared in February its intention to close the two mines remaining in central Sweden, Grängesberg and the smaller Dannemora Mine, in 1989 as part of its rationalization program. Dannemora, about one-third as large as Grängesberg, was less likely to operate at a loss than the larger mine and remained within the company. Total output of the two mines during 1987 accounted for about 13% of Sweden's total production of iron ore. Approximately 35% of this output went to SSAB's Oxelösund steelworks and the remainder was exported. SSAB argued that it was less costly to import iron ore or purchase it from LKAB.

State-owned LKAB produced 87% of Sweden's iron ore from two deep mines north of the Arctic Circle and accounted for 93% of export sales. Profitability decreased because of falling world market prices caused by the falling U.S. dollar and inroads into the world market caused by low-cost ore from rich surface mines, especially in Australia and Brazil. Sweden's iron ore output was mostly exported to Western Europe, with the Federal Republic of Germany and Belgium-Luxembourg taking more than 50%. Although overall demand was down, demand for LKAB's high-grade pellets was up because ore-sintering capacity was shrinking in Europe. Production of LKAB's lump ore, all of the high-phosphorus variety, decreased because of decreased demand in Europe. LKAB production in 1987 was pellets, 53%; lump ore, 13%; and fines, 34%.

Manganese.—Manganese-rich nodules were discovered by Luleå University of Technology at water depths of 200 to 350 feet in the Gulf of Bothnia between Luleå and Vaasa, Finland. Large areas, up to 70 square miles, containing approximately 40,000 tons of nodules per square mile, were identified. Estimated reserves exceeded 1 million tons of manganese at a concentration of about 13%. The Swedish steel industry was dependent on imports for its manganese requirements.

Molybdenum.—Metallurg Inc., based in New York, sold its Ferrolegeringar Trollhättenverken AB plant in Trollhättan to Swedish steelmaker Sandvik AB. The plant, consisting of a 2,000-ton-per-year-Mo-content molybdenum oxide roaster and a grinding facility, employed 50 people. It was operating at full capacity using imported

raw material. Sandvik planned to use most of the product in its specialty steel manufacturing. The major feature of the plant, a 35,000-ton-per-year ferrochrome smelter, had closed in 1986.

Steel.—SSAB, mainly state-owned, produced about 80% of Sweden's rolled steel tonnage and was essentially the only producer of carbon steel. The major source of its iron ore was LKAB. Metallurgical coke was made by SSAB from imported coal, mostly from the United States. The Government sold some of the company's shares during 1987 to financial institutions. The company reorganized at yearend to help ensure a consistent future profit. Restructuring, begun immediately, included closing facilities that produced unprofitable products such as reinforcing bars. The company planned to emphasize steel sheet production and concentrate on the domestic market.

The SSAB was to have most of its operations at three major facilities, the Luleå steelworks in the far north near the LKAB iron mines, the Oxelösund steelworks 30 miles south of Stockholm, and the Domnarvet steel sheet-rolling plant 60 miles northwest of Stockholm. Rolling mills were also located at Luleå and Oxelösund. The company's new business organization consisted of three product divisions. The largest, SSAB Strip Products with 60% of total volume, consisted of a 700,000-ton-per-year coking plant and a 1.6-million-ton-per-year blast furnace smelter at Luleå, and a temporary electric arc furnace based on scrap at Domnarvet. Strip Products also had the Domnarvet sheet-rolling complex, which included a 2-million-ton-per-year wide-strip hot mill, a 900-million-ton-per-year cold-rolling mill, and lines for application of metal and plastic coatings to the sheet. SSAB Oxelösund, with 25% of total product capacity, consisted of a 450,000-ton-per-year coking plant, a 1.2-million-ton-per-year blast furnace smelter with systems for continuous casting of slab, and a hot-rolling mill, mainly for production of heavy plate, the unit's major product. SSAB Profiles, the third unit, was responsible for 15% of SSAB's total product capacity. Products were to be mostly heavy rolled sections made at Luleå and rails produced at Domnarvet.

SSAB closed or began shutting down outdated facilities during 1987, including a billet machine and a rolling mill at Luleå and a strip mill at Domnarvet and Surahammer. Decisions were made at yearend to invest in a second continuous-slab casting machine at Luleå and sheet-roll changing equipment and a second heat-treating furnace at Domnarvet at a cost of $100 million. The electric arc furnace at Domnarvet was to be closed when the second slab casting machine at Luleå became operational. Manufacturing of reinforcing bars, wire rod, and light-gauge long products was discontinued at yearend.

The larger blast furnace at Luleå suffered extensive damage early in the year, causing a production loss of 100,000 tons of steel. Production disturbances in the coking plant at Luleå necessitated a 15% use of imported coke. Extensive repairs were begun at Luleå. These costs were charged to the 1987 account. The company's 1987 profit after depreciation, $100 million, was aided by the transfer of the Grängesberg iron mine to the Government. Raw materials were less costly during the year because of the declining dollar and keen world competition.

Sweden's major specialty steel producers all reported improved results in 1987. Ovako Steel AB, the large new Finnish-Swedish specialty steel company, announced a 25% increase in annual raw steel capacity in its Hofors Tube Works, to 400,000 tons per year over the following 2 years. The company also invested $47 million in new finishing equipment at its Hällefors Works, raising annual bright bar capacity to 50,000 tons. Billet production at Hällefors was scheduled to terminate in 1989 upon shutting down the electric arc furnace. Ovako's overall specialty steel capacity was expected to remain near 1 million tons per year after making these changes. The other major specialty steel producers were Avesta AB and Sandvik Steel AB. Fagersta Stainless AB, jointly owned by Avesta and Sandvik, announced that it intended to invest $20 million in updating its rolling mill, thereby increasing output and productivity. European demand for stainless steel increased significantly during the year.

The U.S. Department of Commerce found in February that Avesta Sandvik Tube AB, the Swedish producer of stainless steel tube and pipes, had been indirectly subsidized by the Swedish Government in past years. Consequently, Commerce asked for a 2.18% countervailing duty on imports of Swedish hollow stainless steel products. However, the case was thrown out in March by the U.S. International Trade Commission (ITC). U.S. producers again urged the ITC in

October to impose the duty. Meanwhile, the ITC had decided in May that ending import restraints on stainless steel bar and rod and on alloy tool steel would adversely affect U.S. industry. In July, the U.S. Government extended the restraints for another 3 years, including a 3% tariff that decreased by 1% each year. The Swedish Government continued to contest the restraints, both directly to the U.S. Government and in international trade forums.

Zinc.—SKF Plasma Technologies AB reported that its prototype arc-plasma process for recovery of zinc metal from carbon-steel-mill bag dust operated continuously at near capacity throughout most of 1987. The annual production rate from the unit at Lanskrona was approximately 11,000 tons of Prime Western grade zinc from 55,000 tons of dust. Many design changes occurred during the furnace's intermittent operation period from 1984 until yearend 1986, including the design and construction of a satisfactory zinc metal condenser. The plant was initially operated by Scan Dust AB, a subsidiary of former SKF Steel Engineering AB. The bag dust was mixed with powdered coal and fluxes and fed, along with a carrier gas, into a 6-megawatt, water-cooled, coke-filled shaft furnace. Heat was supplied by arc-plasma generators placed symmetrically around the bottom of the furnace. The zinc vapor was absorbed in a spray of lead metal droplets in the condenser. Prime Western-grade zinc was subsequently separated in liquid form by cooling the molten lead-zinc alloy. The process met environmental standards, after a method was devised to recover small amounts of mercury vapor released during the reduction step. The process presented industry with a technically feasible and environmentally acceptable option for getting rid of baghouse dusts from steel plants. The dusts have been cited as an environmental problem.

INDUSTRIAL MINERALS

Nitrogen.—Supra AB, Sweden's only fertilizer manufacturer, closed its ammonia plant in Köping because of high production costs. The 25-year-old-plant's process was based on fuel oil feedstock. Supra AB was 75%-owned by Norsk Hydro A/S, the giant Norwegian fertilizer, oil, and aluminum producer.

Sulfur.—Boliden announced during the second half of the year that it would close by 1989 the smaller of two sulfuric acid plants and one of its two liquid SO_2 plants at its Ronnskar smelter as part of its program to reduce SO_2 emissions from the smelter by 50%. Total acid production would be affected minimally but SO_2 production would be reduced significantly.

MINERAL FUELS

Closure of the nuclear power industry by the year 2010 continued to be the dominant energy policy in Sweden. A new energy bill presented to Parliament in May would close 2 of the 12 reactors during the mid-1990's. The first to be closed would be the Barsebäck reactor across the water from Copenhagen, Denmark. In addition, four large rivers were exempted from hydropower development, thereby eliminating an estimated 2,300 megawatts (MW). Nearly all of the 19,000 MW of Swedish electric power was generated by nuclear reactors, 50%, and hydropower, 46%. Most leaders of the minerals industry and much of its work force were opposed to the nuclear phaseout because the resultant higher cost of electric power would price mineral products out of the world markets, resulting in plant closures. Proponents of ending nuclear power argued in favor of strict conservation efforts, large imports of natural gas, and development of alternate domestic energy sources, many of them renewable. They said these remedies could, if applied rigorously, suffice to maintain a viable economy, albeit somewhat less robust. Energy conservation was to be promoted through improved thermal insulation, use of heat pumps in buildings, and energy-efficient lighting. Alternative domestic power sources included wood, wind, straw, peat, and industrial wastes. Coal-burning power stations were to be made more environmentally acceptable by applications such as the use of limestone in fluidized-bed combustion chambers. This technology was being incorporated into a new 400-MW station planned at Oxelösund and two smaller 200-MW stations under construction in Stockholm.

Future importation of large volumes of natural gas from Norway and the U.S.S.R. was being emphasized as a viable option by yearend in view of methane's clean burning characteristics, its relatively low cost, and large reserves. Discussions began with both nations. A preliminary long-range preliminary plan was to construct a gas pipeline network throughout Sweden such that gas could be imported into the country without favoring any single exporting country. A direct pipeline from the undeveloped Hal-

tenbanken area of the Norwegian Sea would be very costly, requiring pipelaying through much rugged undersea and overland terrain in Norway and Sweden. A less expensive option was to tie Norwegian North Sea reserves to Danish North Sea pipelines already connected to Sweden, but this would expose the gas to potentially expensive Danish transport fees.

The 100-mile gas pipeline under construction in Sweden from Malmö to Göteborg for distribution of natural gas imported from Denmark reached Falkenberg by yearend, about 60% of the way. The Sweden-U.S.S.R. boundary line in the Baltic Sea was finally agreed upon after 18 years of negotiations. The Swedish Government began preparing for petroleum exploration in the Baltic east of Gotland.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Swedish kronor (SKr) to U.S. dollars at the rate of SKr6.33 = US$1.00, the average for 1987.

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